

## ABSTRACT OF THE DISCLOSURE

An optical code-division multiple-access (O-CDMA) apparatus, network, and communications method. A transmitter data modulates a sequence of ultra-fast ( $\sim 1$ ps) pulses. An encoder wavelength demultiplexes the pulses, separately phase-modulates the wavelength components according to a first CDMA code and wavelength multiplexes for transmission on an optical network. A receiver includes a decoder performing similar demultiplexing, phase-modulating according to a second CDMA code, and multiplexing. The receiver detects the resultant signal. If the two CDMA codes match, the detected signal replicates the data-modulated pulses. The apparatus may be formed in as few as one substrate. The encoder/decoder structure may be used to compensate the dispersion of a fiber. A short-pulse detector includes a Mach-Zehnder interferometer having two semiconductor amplifier regions in its two arms with differential delay/phase between them. A probe signal and the signal to be detected are both split into the arms together and thereafter differenced on the output.